Univerza v Mariboru

MEDICINSKA FAKULTETA

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION	
Predmet:	Izbrane vsebine in novosti v biofiziki in medicinski fiziki
Subject Title:	Selected topics and novelties in biophysics and medical physics

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Splošna medicina General Medicine - EMŠP		1	**2**

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Labor work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
5	40				45	**3**

Nosilec predmeta / Lecturer: Red. prof. dr. Milan Brumen

Jeziki / Languages: **Predavanja / Lcture:** slovenski/ Slovene
Vaje / Tutorial:

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisits:

Vsebina:

Transport snovi preko celične membrane, osmoza, ionski prenašalci in črpalke. Kalcijeva signalizacija v celičnih procesih. Prenos signala med celicami. Biofizikalni mehanizmi krčenja mišice in kontraktilnih proteinov. Molekularni motorji. Biomehanika kosti in mišic. Biofizika dihalnega sistema. Biofizika srčnožilnega sistema. Biofizika prenosa živčnega signala. Biofizika vida. Biofizika sluha. Biofizikalni vidiki ionizirajočega sevanja. Napredne eksperimentalne metode v biofiziki in medicinski fiziki.

Content (Syllabus outline):

Cell membrane transport, osmosis, ionic carriers and pumps. Calcium signalization in cell processes. Signal transmission between cells. Biophysical mechanisms of contraction of muscles and contractile proteins. Molecular motors. Biomechanics of bones and muscles. Biophysics of respiratory system. Biophysics of cardiovascular system. Biophysics of transmission of a nerve signal. Vision biophysics. Biophysics of hearing. Biophysical aspects of ionizing radiation. Advanced experimental methods in biophysics and medical physics.

Temeljni literatura in viri / Textbooks:

- George B. Benedek, Felix M.H. Villars: Physics with Illustrative Examples from Medicine and Biology: 1. Mechanics, 2. Statistical Physics, 3. Electricity and Magnetism; Springer Verlag, New York 2000.
- Russell K. Hobbie: Intermediate Physics for Medicine and Biology; John Wiley & Sons, New York 1997.
- Jack A. Tuszynski, Michal Kurzynski: Introduction to Molecular Biophysics, CRC Press, Boca Raton 2003.
- Roland Glaser: Biophysics; Springer Verlag, Berlin 2001.
- Milan Brumen: Ravnovesna porazdelitev vode in ionov prek celične membrane. Med. razgl., 25 (1986) 167-177.
- Gleb B. Sukhorukov and Helmuth Möhwald: Multifunctional cargo systems for biotechnology. Trends in Biotechnology, 25 (2006) 93-98.

Cilji:	**Objectives:**
Na osnovi fizikalnih konceptov in zakonitosti ter biofizikalnih mehanizmov osvojiti razumevanje fizioloških procesov v človeškem organizmu ter bioloških procesov na ravneh tkiva, celice ter supramolekularnih in makromolekularnih struktur. Razumeti fizikalne osnove naprednih diagnostičnih in terapevtskih metod medicinske fizike.	To comprehend human physiological processes as well as biological processes running on different levels of biological organisation such as tissues, cells, and supramolecular and macromolecular structures, from the point of view of physical concepts and laws and biophysical mechanisms. To comprehend basic physics of advanced diagnostic methods and therapeutic methods of medical physics.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Študentje osvojijo razumevanje različnih procesov v biologiji in fiziologiji na osnovi fizikalnih konceptov in zakonov ter biofizikalnih mehanizmov in modelov. Prenesljive/ključne spretnosti in drugi atributi: Študentje znajo uporabiti biofizikalne modele za obravnavo strukture in funkcije izbranih bioloških sistemov in primerov iz humane fiziologije. Študentje razširijo razgledanost na področju naravoslovja.	Knowledge and Understanding: Students get understanding of various processes in biology and physiology based on concepts and laws in physics as well as on biophysical mechanisms and models. Transferable/Key Skills and other attributes: Students are able to use biophysical models for discussing structure and function of selected biological systems and cases in human physiology. They become well broadly versed in science.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja. Seminar.	Lectures. Course work.

Načini ocenjevanja:	Delež (v %) / weight (in %)	**Assessment:**
Seminar	**100 %**	seminar

Reference nosilca / Lecturer's references:

DOBOVIŠEK, Andrej, FAJMUT, Aleš, BRUMEN, Milan. Strategy for NSAID administration to aspirin-intolerant asthmatics in combination with PGE [sub] 2 analogue: a theoretical approach. Medical & biological engineering & computing, ISSN 0140-0118. [Print ed.], 2012, vol. 50, no. 1, str. 33-42, doi: 10.1007/s11517-011-0844-x. [COBISS.SI-ID 18845192], [JCR, SNIP, WoS do 5. 4. 2012: št. citatov (TC): 0, čistih citatov (CI): 0, normirano št. čistih citatov (NC): 0, Scopus do 28. 8. 2013: št. citatov (TC): 1, čistih citatov (CI): 1, normirano št. čistih citatov (NC): 1]

MBIKOU, Prisca, FAJMUT, Aleš, BRUMEN, Milan, ROUX, Etienne. Contribution of Rho kinase to the early phase of the calcium-contraction coupling in airway smooth muscle. Experimental physiology, ISSN 0958-0670, 2011, vol. 96, issue 2, str. 240-258, ilustr., doi: 10.1113/expphysiol.2010.054635. [COBISS.SI-ID 18009864], [JCR, SNIP, WoS do 8. 5. 2013: št. citatov (TC): 4, čistih citatov (CI): 4, normirano št. čistih citatov (NC): 1, Scopus do 10. 4. 2013: št. citatov (TC): 5, čistih citatov (CI): 5, normirano št. čistih citatov (NC): 2]

DOBOVIŠEK, Andrej, FAJMUT, Aleš, BRUMEN, Milan. Role of expression of prostaglandin synthases 1 and 2 and leukotriene C [sub] 4 synthase in aspirin-intolerant asthma: a theoretical study. Journal of pharmacokinetics and pharmacodynamics, ISSN 1567-567X, 2011, vol. 38, no. 2, str. 261-278, doi: 10.1007/s10928-011-9192-6. [COBISS.SI-ID 18203144], [JCR, SNIP, WoS do 5. 6. 2013: št. citatov (TC): 2, čistih citatov (CI): 1, normirano št. čistih citatov (NC): 0, Scopus do 23. 10. 2013: št. citatov (TC): 3, čistih citatov (CI): 2, normirano št. čistih citatov (NC): 1]

HALOŽAN, David, RIEBENTANZ, Uta, BRUMEN, Milan, DONATH, Edwin. Polyelectrolyte microcapsules and coated CaCO3 particles as fluorescence activated sensors in flowmetry. Colloids and surfaces. A, Physicochemical and Engineering Aspects, ISSN 0927-7757. [Print ed.], 2009, vol. 342, str. 115-121, ilustr., doi: 10.1016/j.colsurfa.2009.04.024. [COBISS.SI-ID 64115201], [JCR, SNIP, WoS do 13. 8. 2013: št. citatov (TC): 12, čistih citatov (CI): 12, normirano št. čistih citatov (NC): 4, Scopus do 24. 12. 2013: št. citatov (TC): 13, čistih citatov (CI): 13, normirano št. čistih citatov (NC): 5]

DOBOVIŠEK, Andrej, ŽUPANOVIĆ, Paško, BRUMEN, Milan, JURETIĆ, Davor. Maximum entropy production and maximum Shannon entropy as Germane principles for the evolution of enzyme kinetics. V: DEWAR, Roderick C. (ur.). Beyond the second law : entropy production and non-equilibrium systems, (Springer complexity), (Understanding complex systems, ISSN 1860-0832). Berlin; Heidelberg: Springer, cop. 2014, str. 361-382, graf. prikazi. [COBISS.SI-ID 20311048]